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like a bureaucrat, was incessantly plotting for his own hand and pocket against the interests of the partnership. True science and politics are incompatible. They can not exist together any more than the eagle and the squid can share the same apartment. Science has at this moment the most magnificent opportunity that it has ever enjoyed of seizing the steersmanship of human destiny. Every man who wants to see his country great, progressive and prosperous, marching as a standard-bearer at the head of the advancing legions of mankind, should back the scientists with every ounce of energy that he possesses. If, otherwise, he wishes to see her mean, petty, retrogressive, squalid and contemptible, let him support a return to our debasing party strifes, with their concomitant triumph of the political schemer and all the host of parasites whom he enriches out of public money.—*London Financial News.*

SCIENTIFIC BOOKS

Die Grundlagen der Psychologie. Von THEODOR ZIEHEN. Leipzig und Berlin, B. G. Teubner, 1915. 2 volumes. Pp. vi + 259; vi + 304. Price M. 4.40, geb. M. 5.

Professor Ziehen, long known to psychologists as the author of a very readable "Introduction to Physiological Psychology," has undertaken in his latest work to determine the fundamental principles of psychology. According to his view the science rests upon a twofold basis, its epistemological foundation, and the basal principles of the science itself. The latter may be investigated "autochthonously," that is, with respect to the psychical alone, or in correlation with non-psychical material. The latter investigations furnish the psychophysical and psychophysiological foundations of psychology. In the present work only the epistemological and autochthonous principles are discussed—each in a separate volume.

The author's epistemological standpoint is rigidly phenomenalist. He starts with the totality of the Given (das Gegebene), which he calls the Gignomene. This primary datum is divided into two fundamental classes, sensations and representations (Vorstellungen).

The latter are derivatives of the former. The psychical, which constitutes the subject matter of psychology, is to be regarded as the totality of the Given in relation to a certain "component" of the sensations and representations.

Every sensation datum can be analyzed into two constituents, a "reduction" component and a parallel component. The former is subject to a certain sort of variation—successive changes—and such partial variations constitute the causal series. The second component is subject to a different sort of variation—simultaneous changes—which form the parallel grouping of data. The parallel group includes both independent and dependent variations. The independent variations, so far as we know, occur only in the brain and nervous system. All sensations are subject to dependent variation. Thus among our sense data there are some which stand only in causal and *passive* parallel relations to other data, and some which manifest *active* parallel relations as well—that is, data which produce parallel *effects*. The representative data are resolvable into components analogous to those of sensations. Psychology, according to the author, is the science of the passive parallel components of experience. Such, in bare outline, is Professor Ziehen's demarcation of psychology. Unfortunately, in spite of his endeavor to give mathematical precision to the analysis the meaning of his fundamental terms remains somewhat in doubt.

The fourth chapter contains a very incisive discussion of the historic theories of the Self. The author finds no sufficient ground for assuming the existence of a soul-substance or mind-stuff. The self is merely "an individual collective concept, distinguished by special characteristics" (I., 140). The existence of "other selves" he believes to be comprehensible from his standpoint, while the substance theory, carried out logically, lands us in solipsism.

In Chapter 5 the relation of the "psychical" to the brain is examined. The classic theories, which he designates as causalism, parallelism, materialism, spiritualism, identism and logis-

tical unitarism, are all set down as dualistic. His own solution of the problem is that "the psychical and the material are not two distinct entities, but denote two different kinds of regularity—parallel regularity and causal regularity" (I., 150).

The following chapter treats of consciousness. In common usage the term *consciousness* has three essentially different meanings: it denotes (1) a substantial unitary "self" or "soul," (2) a specific process or function in the psychical sphere, (3) a specific property of the psychical. None of these uses appears satisfactory. According to the author, as already stated, "the psychical denotes not a specific entity, but merely the Gignomene in so far as the latter includes parallel components in accordance with the parallel laws" (I., 206). The notion of unconscious mental processes is not only self contradictory, but it is quite superfluous from his viewpoint. On the other hand, the "reduction constituents" of the datum are unconscious, and in this sense the term "unconscious" has a valid meaning. The first volume concludes with a discussion of the relation of psychology to logic, esthetics and ethics.

In the second part Professor Ziehen develops the autochthonous foundations of psychology. He recognizes both the objective and the subjective methods of research, including under the latter self-observation and observation of others. But according to his view "introspection" is not a special process: it is rather an associative mode of succession of mental processes. The introspection of a sensation is a representation corresponding to that sensation, and the representation of a representation is merely a repetition of the latter. Both induction and deduction are appropriate methods of investigation in psychology proper, whereas in psychophysics and psychophysiology only induction is admissible. Under induction he includes the genetic and experimental methods, but considers the questionnaire method a caricature of the true experimental procedure.

The aim of psychology may be either general or individual. Under general psychology

he includes anthropological psychology, animal psychology, and the special fields of general mass psychology and the psychology of types. Under individual psychology he notes one special field: special mass psychology.

The remainder of the work is devoted to an examination of the psychical subject-matter. The two universal characteristics of the psychical are temporality and variability. At the outset the author had divided the primary datum into sensory and representative Gignomene. Whether or not this classification is exhaustive can only be determined by analysis of every sort of experience. Taking up the various types of experience which psychology has recognized as fundamental, he proceeds to show that they are all reducible to sensations and representations, or transformations of representations, or their simultaneous and successive combinations. The author's analysis of judgment, feeling and volition is especially thorough and interesting. Judgment is resolved into a particular sort of representation. The hedonic experiences, instead of forming a third distinct group of data, are found to be merely specific properties of sensations and representations. Volitions are reducible to certain combinations of sensory and representative data—namely, those in which a strong pleasure-tone is united to the representation of a "purpose."

Professor Ziehen's book will interest the psychologist of a speculative turn of mind. His attempt to resolve the data of experience into causal and parallel components is a definite contribution to the mind-body problem. To the present reviewer, though he differs with the author in standpoint, the theory appears to be developed logically from plausible premises. The obscurity of language in the early part of the analysis may be due to the difficulty of defining fundamental ideas such as reduction-component, etc., or it may be the result of attempting to treat non-mathematical terms by means of algebraic symbols and operations. Whatever the reason, the analysis here is exceedingly difficult for even the psychologist to comprehend. It is doubtful whether the physicist and physiologist, to whom these

concepts are quite novel, will be able in general to follow the author's reasoning.

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February 8, 1916

The Permo-Carboniferous Red Beds of North America and Their Vertebrate Fauna. By E. C. CASE. Carnegie Institution of Washington.

In this monograph Dr. Case has summarized our knowledge to date of the vertebrates from these Permo-Carboniferous beds, which, for a period of over forty years, have been yielding remains of essential interest to paleontology; because the beds, laid down at a time when the amphibians were dominant and the reptiles were in the transitional stages, have preserved the most complete skeletons of these early vertebrates, and it is essential to know these Cotylosaurs, Pelycosaurs, etc., in order to attain a correct idea of the further development of the reptiles and the ancestry of the mammals.

His careful description of the beds and localities invites and clears the way for those who shall follow and collect in these beds, the tedious search for favorable localities and horizons, which hampered the pioneers in this field, being removed by the submission of all this data to the public; and it is a hard field, the fossils being scarce and fragmentary. Then his conclusions from the character of the beds as to the climates and environment are a great aid in the efforts to interpret evolution.

Case gives the range of this fauna as from the Pittsburgh Red Shales in the middle of the Upper Pennsylvanian (Missourian) to the top of the Clear Fork, which is about the middle of the Permian, as described by Schuchert. At this point in time the dominance of this fauna ends in America, though in Europe, it, or an equivalent fauna, runs up into the Triassic.

It is shown that all the amphibians of the fauna are carnivorous, the reptiles partly carnivorous, partly molluscivorous, and partly insectivorous. None were adapted to marine life; none were far advanced even toward

fresh water life; but the fauna is typically one of the estuaries, swamps, alluvial plains and woodlands.

The eighth chapter presents summary descriptions of the best-known genera, illustrated by 23 restorations, which impress the reader with the heavy, slow-moving character of most of these animals, though the drawings leave something to be desired in life-like appearance.

An appendix gives a description of the Brier Creek Bone Bed and its fauna, the locality which has yielded the richest finds of Permo-Carboniferous vertebrates. Some twenty plates show detail photographs of the beds and fossiliferous strata, which will aid any one studying the conditions of deposition, or going into this field, so that with the minimum of experience they can get the best results.

As a whole the volume is one which will ably serve any student of the Permo-Carboniferous, as it brings him up to the present, and will long serve as the starting point for further studies of these beds.

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SPECIAL ARTICLES

AN ELECTRIC COUNTER FOR DETERMINING THE RATE OF A FREE-SWINGING PENDULUM

A HEAVY pendulum, vibrating through small arcs, and unconnected with clockwork or escapement, possesses several advantages for recording time in graphic experiments. It is simple, and easy to construct, and is more accurate than some more complicated apparatus used for this purpose. Its especial merit is that its consecutive swings are so perfectly isochronous that it can be employed for testing tuning-forks and other vibrating recorders. In testing tuning-forks and in similar work it is absolutely necessary that the time intervals should be equal. As the vibrations of the pendulum of a clock are liable to be affected by irregularities in the action of the motive power, it is possible that they may not be perfectly isochronous when their number in a considerable period of time is correct. This objection does not apply to the free-swinging pendulum.